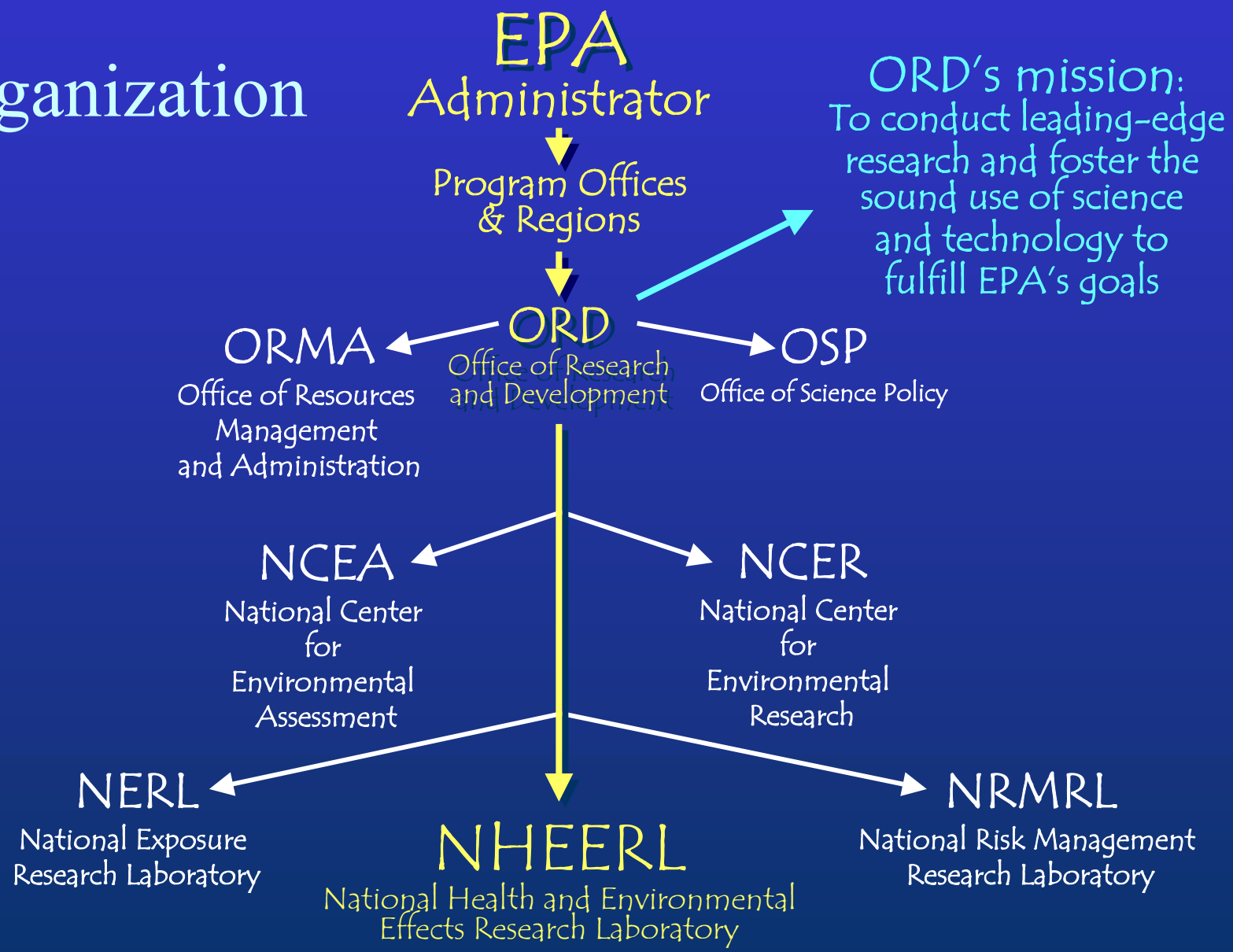
U.S. Environmental Protection Agency's

Office of Research and Development

National Health and Environmental Effects Research Laboratory

Gulf Ecology Division

Organization

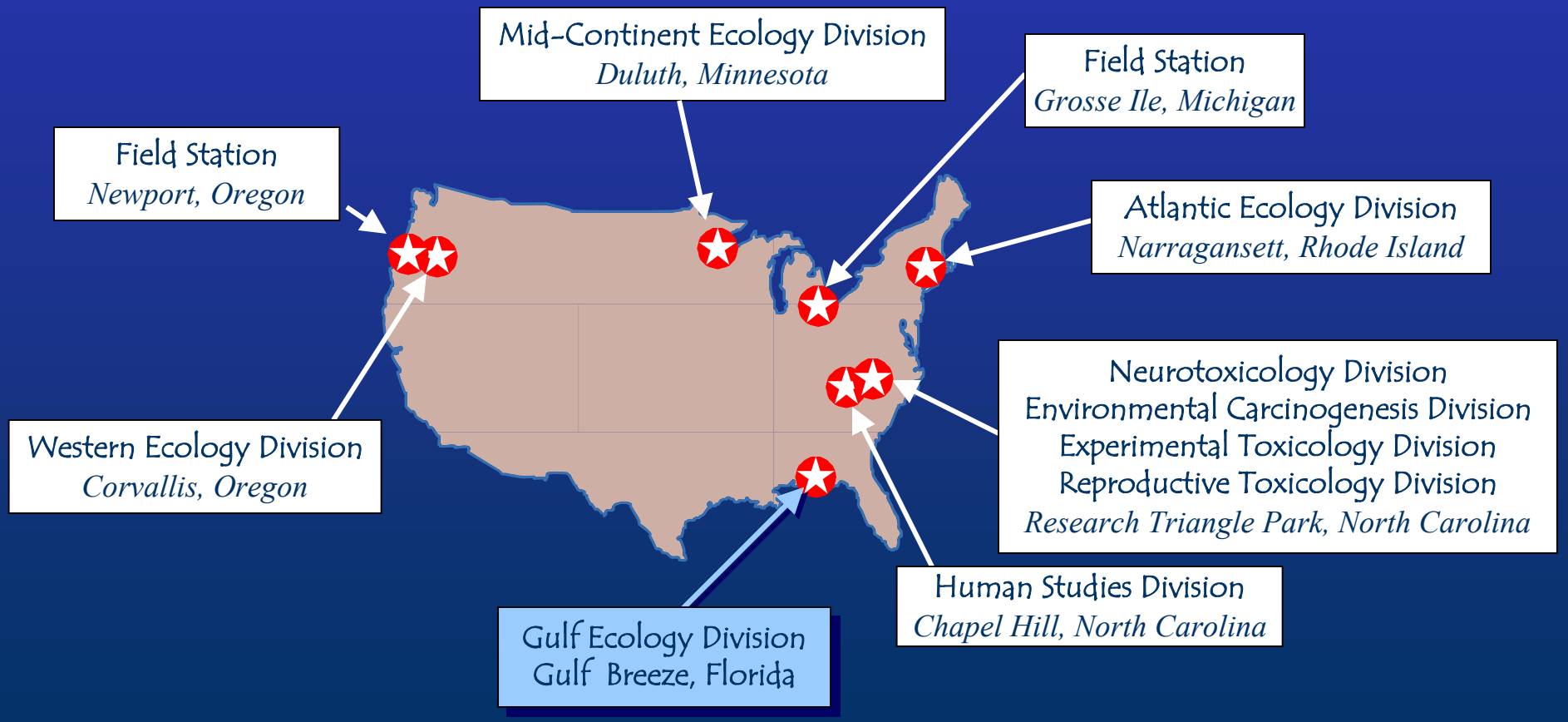


NHEERL's mission is to determine the impacts of environmental stressors on human and ecosystem health and the degree to which those stressors cause harm.

Organization

NHEERL

National Health and Environmental Effects Research Laboratory



Gulf Ecology Division

- **Mission:**
  - **Assess ecological condition of the Gulf of Mexico**
    - **Estuaries**
    - **Coastal wetlands/SAVs**
    - **Coral reefs**
  - **Determine cause(s) of affected and declining systems**
  - **Predict future risk to populations, communities and ecosystems from multiple aquatic stressors**
    - **Toxic chemicals**
    - **Nutrients**
    - **Pathogens and disease**
    - **Critical and threatened habitat**
    - **Nuisance and harmful algal blooms**
  - **Support development of criteria to protect coastal environments**
  - **Technology transfer**

Assessment of Impact

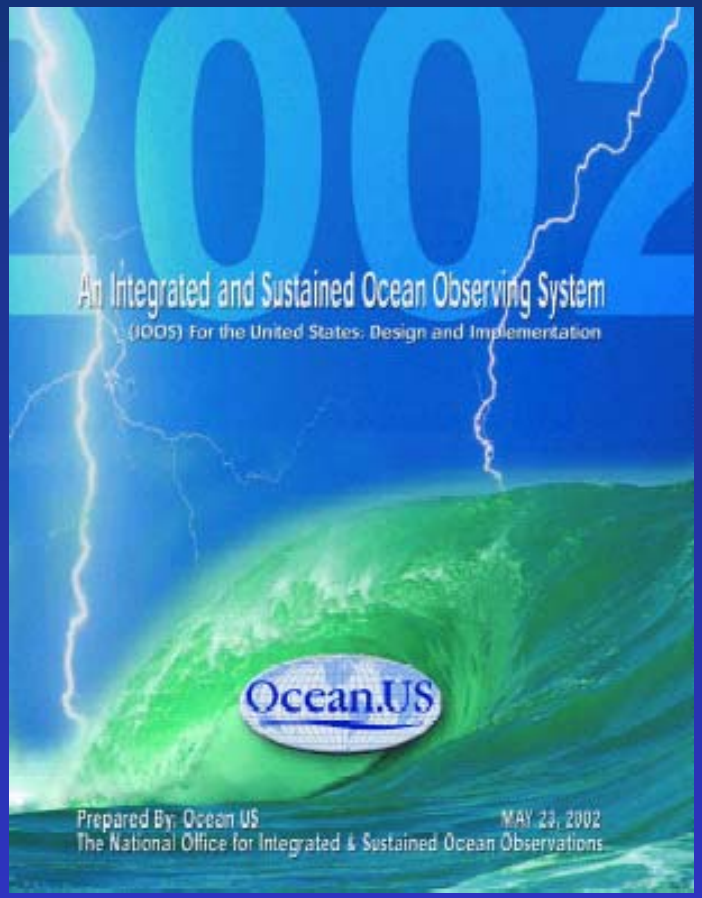
	Research	Advice	Leadership
Quality of the Science	Priorities Resources Communication	Symposia Societies Guidance	Collaborations Advisory Committees Awards
Impact on Agency Needs	Responsiveness Balance Communication	Technical Support	Research Planning Workshops Awards

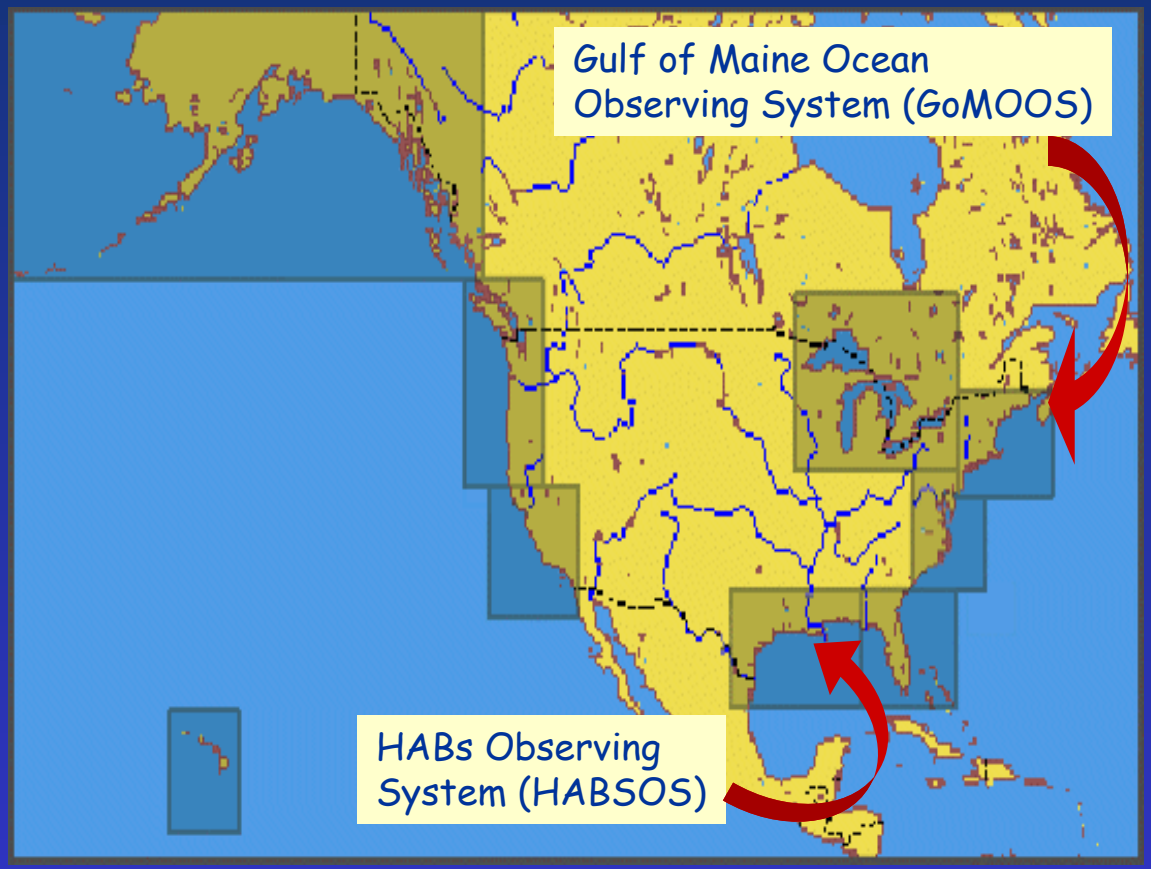
HABSOS
Pilot Project

Building Coastal Partnerships, Data Management Systems
and Communications Networks

HABSOS Pilot Project

One component of future Gulf of Mexico Regional Observing System





A Federation of Integrated Ocean Observing Systems

Why Focus on HABs?

Highly visible through the multiple effects on:

- **Public Health:** Seafood poisoning syndromes (NSP, ASP, DSP, PSP, ciguatera), respiratory irritation, memory and learning disabilities
- **Economy:** shellfish closures, fish kills, beach advisories (tourism); loss of consumer confidence
- **Valued Resources:** finfish, shellfish, manatees, dolphins, sea turtles
- **Unknown ecological effects on:** 'non-charismatic' species and populations; water quality; habitat quality

Incentive for end-user participation

40+ toxic or potentially toxic/harmful species on GOM

Better Management of HAB Events

Timely access to data and information leads to more efficient use of resources

Forecasting when/where blooms will or will not occur will help mitigate adverse effects through:

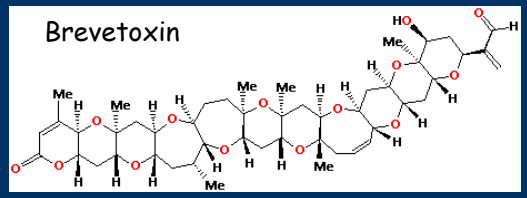
- Early harvest of shellfish
- Altered fishing limits and open seasons
- Strategic placement of aquaculture sites
- Mobilization of response, cleanup, and rehab crews
- Public information and education; beach and shellfish advisories

HABSOS Workshop

Nov. 27 – Dec. 1, 2000
Pensacola Beach, FL

- Brought together data providers and data users (public health and natural resource managers)

- Formulate plans for design and implementation
- Defined and recommended
  - User requirements for data products
  - Data communications and management requirements
  - Requirements for measurements, sensors, and platforms
- Targeted *Karenia brevis*



Sponsored by EPA, NOAA, NSF, NASA

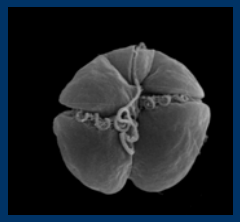
Why *Karenia brevis*?

Most problematic HAB in GOM

Public Health: brevetoxins cause neurotoxic shellfish poisoning and respiratory irritation

Economy: Millions of $$$ per major bloom (bed closures, beach cleanup, tourism, etc)

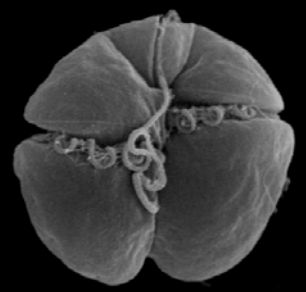
Valued Resources: Mass mortalities of mammals, sea turtles, water fowl, fish and shellfish



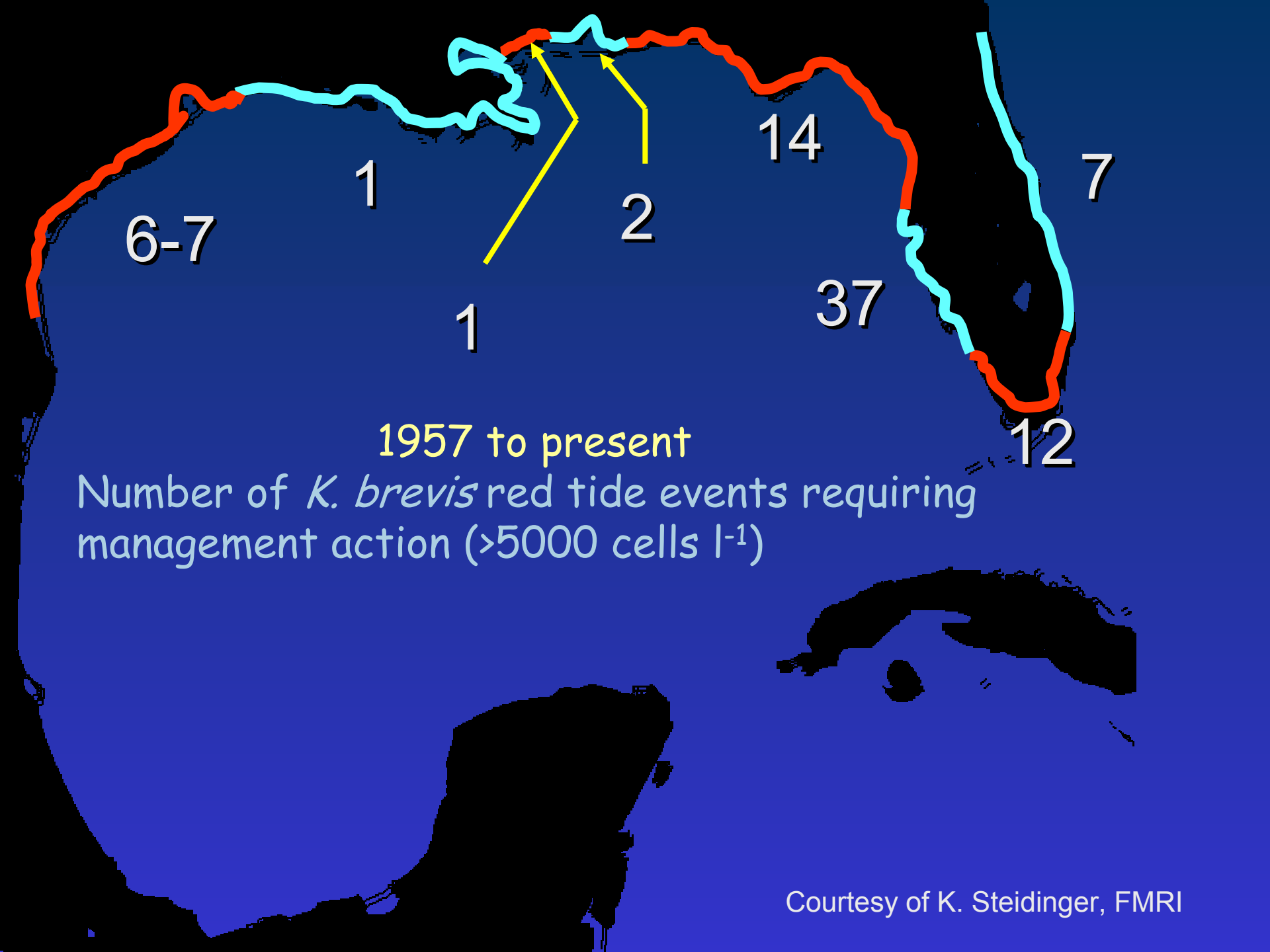
Aquatic mortalities due to Karenia brevis

- Manatees 1963, 1982, 1996 (=149)
- Dolphins 1947, 1987, 1994, 1996, 1999
- Sea turtles 1878, 1946-7, 1996
- Sea birds 1946-7, 1974, 1996

Gulf-wide: Fish & invertebrates 1844-2000



Courtesy of J. Landsberg, FMRI



1957 to present

Number of *K. brevis* red tide events requiring management action (>5000 cells l^{-1})

Courtesy of K. Steidinger, FMRI

HABSOS Pilot Project Goals

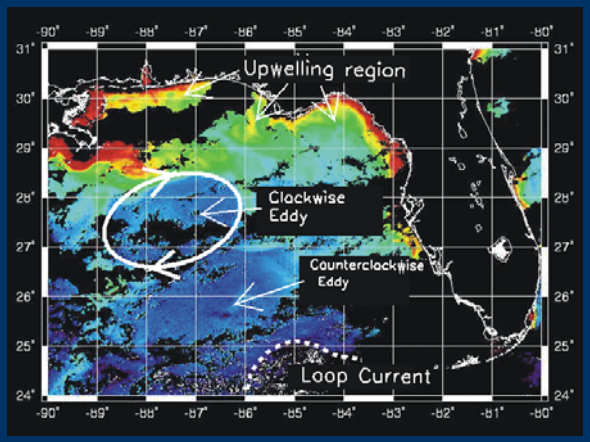
- Design a HAB data management and communication system through
  - networking government agencies and coastal research labs, in order to
  - provide timely access to data and information

- Implementation will lead to
  - more effective/efficient use of collective resources on a regional scale
  - more timely detection, tracking and forecasting

Assemble relevant data and communicate useful information

User Requirements

- State managers make decisions regarding
  - public health (fish/shellfish consumption, bed closures, beach advisories)
  - Aquaculture (sites, disease, mortality)
  - Economic (tourism, beach clean-up, monitoring, fisheries)
  - Dissemination of information to public

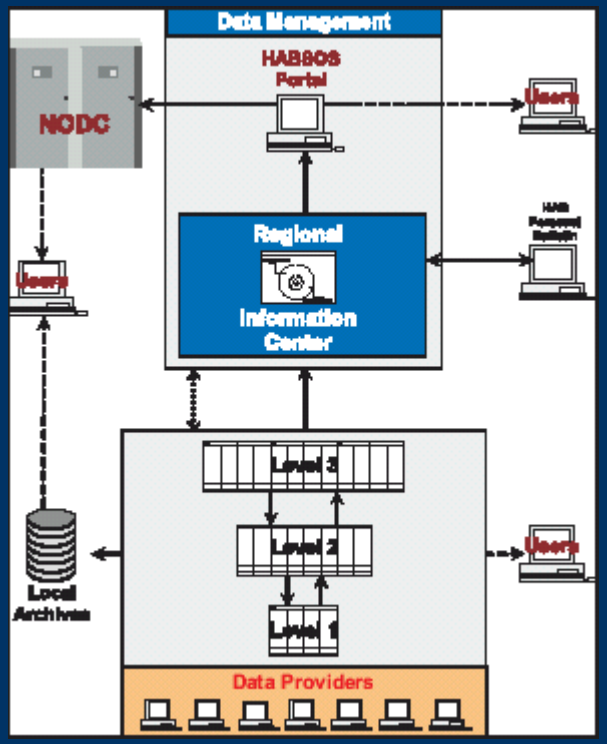


- State managers need/want analyzed data

- 24 h advance notice is high priority
  - An alert that an event is in progress
  - A forecast of where/when (movement, landfall)
  - An alert of conditions favorable for initiation

Data Management and Communications

- Allows users to exploit multiple data sets from various sources
- Considered highest initial priority, but big challenge
- System must –
  - Consider needs of end-users
  - Incorporate metadata standards
  - Mechanism for monitoring/assessing reliability of data flow and usefulness of data products



Challenges to developing data management and communications system

- Little consistency among programs – states operate differently
- Not all data in electronic data bases – if electronic, mostly on individual PCs, and little available online
- No comprehensive inventory of existing/available data/metadata
- Poor communications between State agencies, between State & Federal agencies and between gov't agencies and coastal research labs

HABSOS Workshop
- recommendations for next steps -

- Formulate governance structure –
  - ✓ GMP provides administrative lead and coordinates activities
  - ✓ Establish Steering Committee (includes State reps)
- Establish MOUs - ✓
  (USEPA/GMP, NAML, NCDDC, NMOC, US-GOOS)
- Identify data needs/availability and data providers - ✓
- Develop Action Plan with milestones - ✓
- Develop strategy for funding – partial ✓

HABSOS Pilot Project

Prospectus

The Gulf of Mexico Pilot Project
for a

HARMFUL ALGAL BLOOMS OBSERVING SYSTEM (HABSOS)

FINAL DRAFT

March 1, 2002

Schedule of Activities for HABSOS Pilot Project (Federal fiscal quarters)

	2001		2002				2003			
Performance Measure (PM) /Activity	3	4	1	2	3	4	1	2	3	4
PM 1. Establish a network				X						
Prepare working prospectus	X	X		X						
Establish MOAs among partners	X	X	X	X						
Form Steering Committee			X							
Incorporate essential programs				X						
PM 2. Useful presentation of data						X				
Prototype partial system			X	X	X	X				
Plan for user feedback		X	X	X						
User guidelines				X	X					
PM 3. Regional data availability								X		
Convene expert panel		X								
Perform Case Study		X	X	X	X	X				
Document data availability							X	X		
PM 4. Nowcast and forecast capability									X	
Establish internet communications					X	X	X	X		
Automated data processing								X	X	
User feedback on system					X	X	X	X	X	
PM 5. Resource needs (final report)										X
Essential institutional commitment								X	X	X
Technical gaps, needs									X	X
Cost estimates										X

HABSOS Pilot Project

– Next Steps –

- Draw on HAB expertise around GOM
  - K. Steidinger, FMRI (FL)
  - J. Pennock, DISL (AL)
  - C. Moncreiff, GCRL (MS)
  - Q. Dortch, LUMCON (LA)
  - J. Simons, TPWD, and T. Villareal, UTMSI (TX)

- Select recent years (bloom vs non-bloom) for retrospective case study
  - Identify data potentially useful to monitoring, tracking, forecasting
  - Locate and characterize the scale, extent and format of data

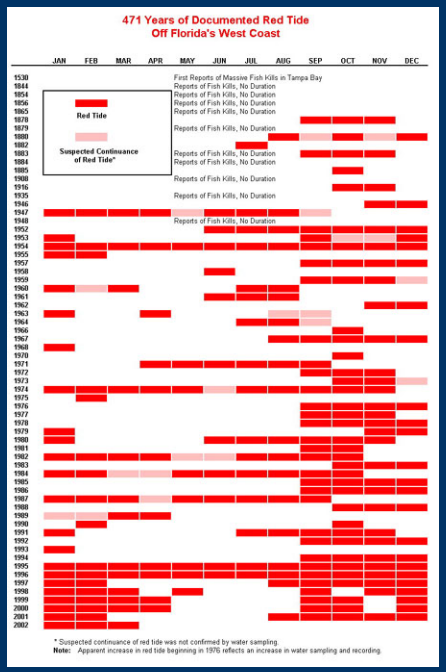
HABSOS Pilot Project
Retrospective Case Study

- Initiates the HABSOS Pilot Project
- Form Case Study Working Group
  - HAB experts plus
    - S. Gallegos (NRL), K. Hamilton (DISL, Castnet), R. Stumpf (NOAA/NOS), T. Orsi (NOAA/NCDDC)
- Retrospective analysis of the regional oceanographic conditions during:
  - 1996 & 2000 - geographically-extensive blooms years
  - 1997 - a geographically-limited bloom year

Major Question: With the relevant data and communication infrastructure in place, could we have forecast or predicted the development, transport and impacts of K. brevis

HABSOS Case Study Objectives

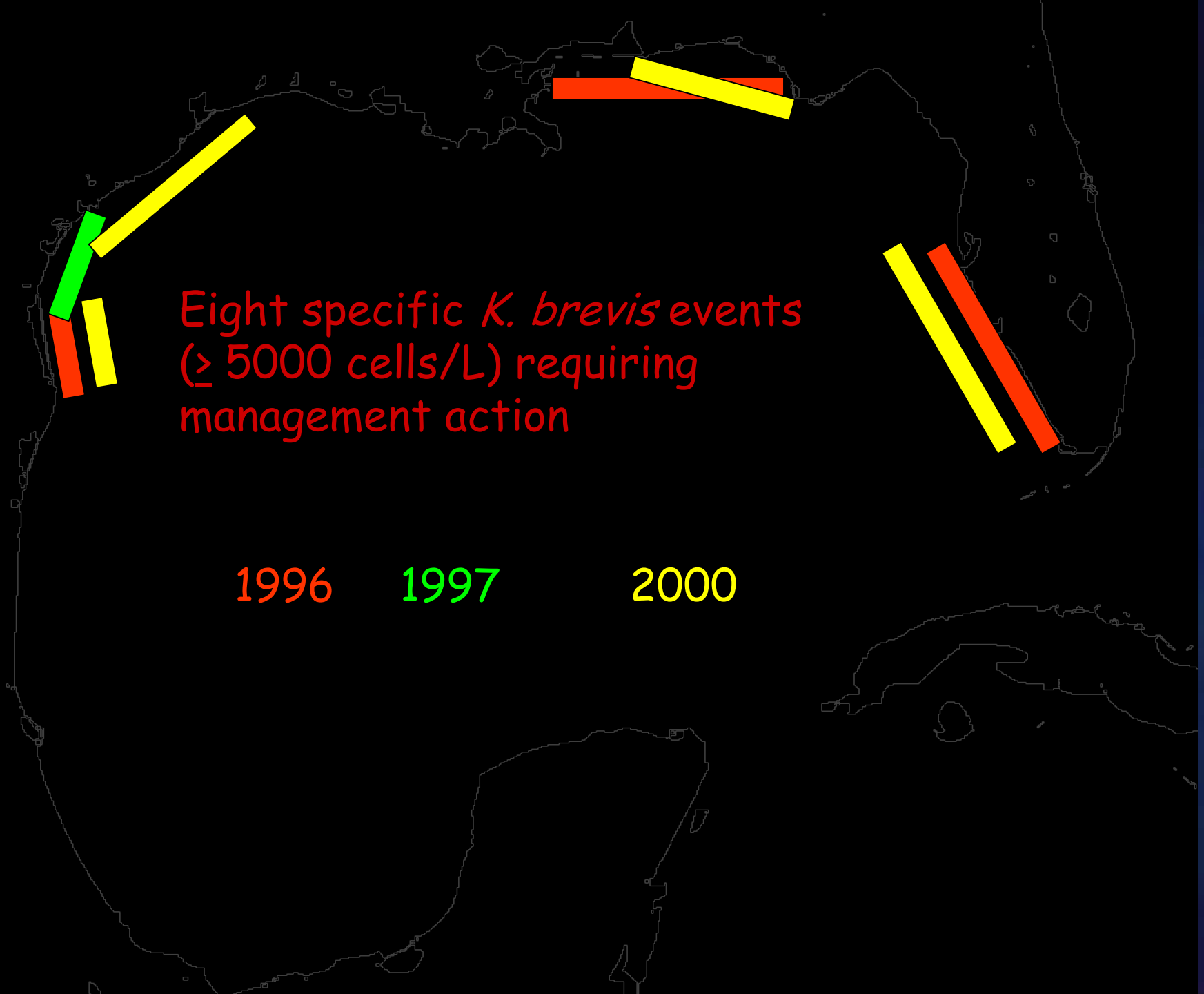
- Identify, characterize, and organize relevant data and information recorded from across the Gulf during 1996, 1997 and 2000
- Integrate relevant data into a regional format applicable to forecasting
  - Characterize and resolve obstacles related to data entry, storage, and retrieval
  - Initiate a network and process for linking and integrating multiple data types from multiple sources
  - Initiate web-based presentation system subject to user feedback
- Identify and characterize specific *K. brevis* events



HABSOS Pilot Project Case Study

Relevant data (✓ on hand, QCed)	Data Sources
✓ *K. brevis* cell counts (geo-referenced)	HAB experts, State DEPs & HDs
✓ Oceanography/Meteorology (SST, salinity, winds, currents)	NRL, NOAA, MMS
✓ Ocean color imagery (2000 only)	NOAA Coastwatch
Aquatic mortalities	GMNET, States
✓ Shellfish bed closures	FDA, State HDs

Other data might be nice to have, but we determined that either it is not critical to our objectives or not routinely measured.


Eight specific *K. brevis* events
(≥ 5000 cells/L) requiring
management action
1996
1997
2000

HABSOS website/portal

habsos - Netscape

File Edit View Go Communicator Help

HABSOS

Monday 25 November 2002 | 03:37 PM CDT *Good Afternoon*

A data and information portal to Harmful Algal Blooms

Participants

National Coastal Data Development Center

Home

In "The State of the Nation's Ecosystems", the Heinz Center identified harmful algal blooms (HABs) as one of the core indicators to the health of the nation's ecosystems. Alarmingly, the frequency, extent, and severity of HAB events appear to be increasing. Although these occurrences can have significant economic and ecological effects, there are no consistent and comprehensive national data to validate this concern.

The Harmful Algal Blooms Observing System (HABSOS) pilot project is a proof-of-concept demonstration of an integrated information and communication system for managing HAB data, events, and effects. The HABSOS pilot project is initially focused on the Gulf of Mexico but will ultimately expand throughout the coastal U.S.

Current Events

Xth International Conference on Harmful Algae , Oct 21-25, 2002, St. Petersburg, FL

NOAA National Coastal Data Development Center - Stennis

Home >>
- What's the Problem?
- Contact Information
- Teachers
- Kids
- GIS Mapping
- Management
- Related Links
- Feedback

Go

Search

88% of 80K

HABSOS-Harmful Algal Blooms Observing System - Microsoft Internet Explorer

HABSOS - Harmful Algal Blooms Observing System

Reset Site

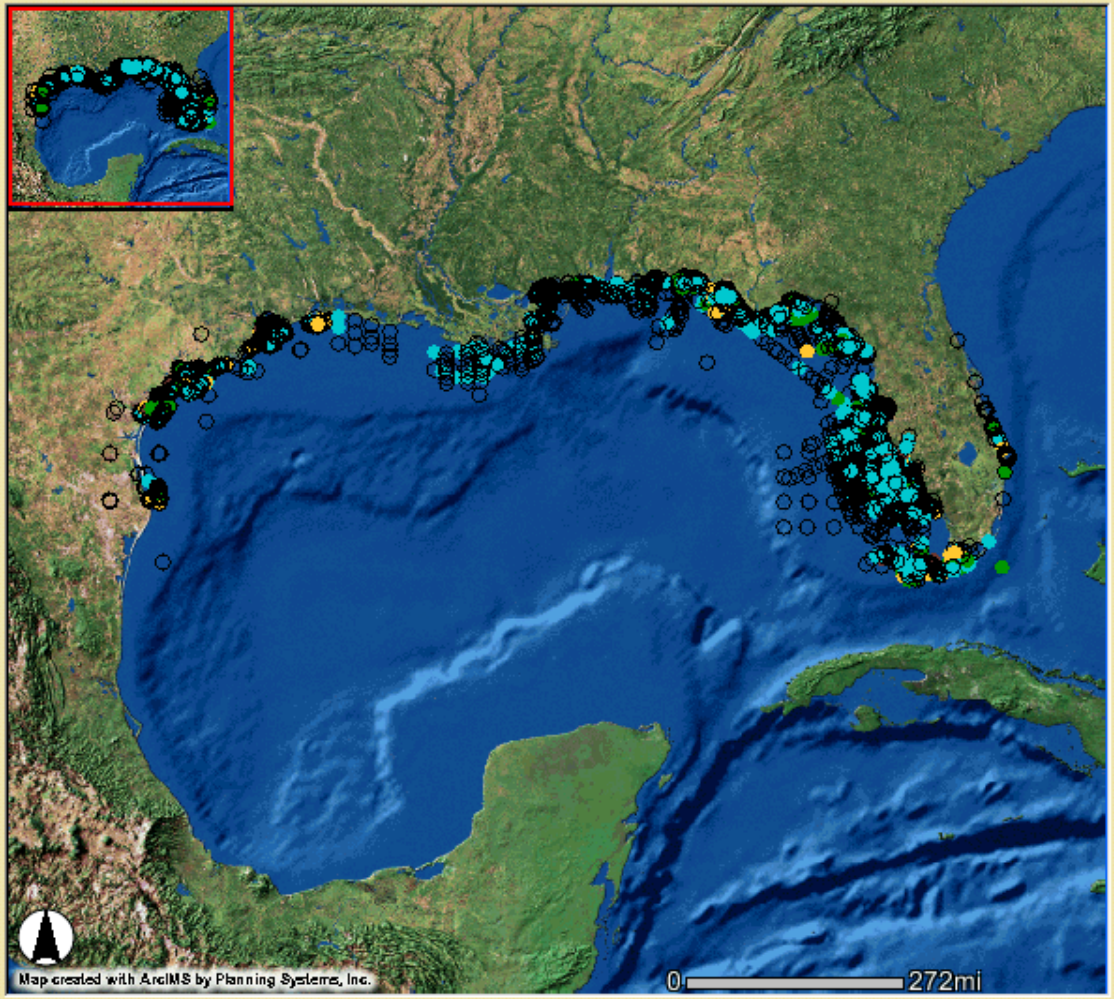
Legend | Toggle | Zoom In | Zoom Out | Full Extent | Active | Last | Pan | Identify | Query | Find | Clear | Print

Layers

Visible Active

- [x] (•) GOM Cell Counts
- [ ] ( ) County Boundaries
- [ ] Satellite image
- [x] Relief Image

Not Present:	0 - 1000
Very Low:	5,000 - 10,000
Low:	10,000 - 100,000
Medium:	100,000 - 1,000,000
High:	≥ 1,000,000



Texas | Louisiana | Mississippi | Alabama | Florida

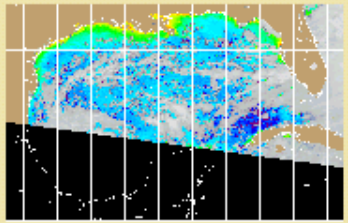
Time Series Model

Begin Year: 1996 — End Year: 2001

Begin Month: January — End Month: December

Begin Day: 1 — End Day: 31

Submit



Map It

- ( ) SST
- (•) Chlorophyll

Cell Counts

- Not Present
- Very Low
- Low
- Medium
- High

Refresh

Active Tool: Zoom In

|<< | << | Current Date | >> | >>|

NOAA National Coastal Data Development Center web server

HABSOS-Ha

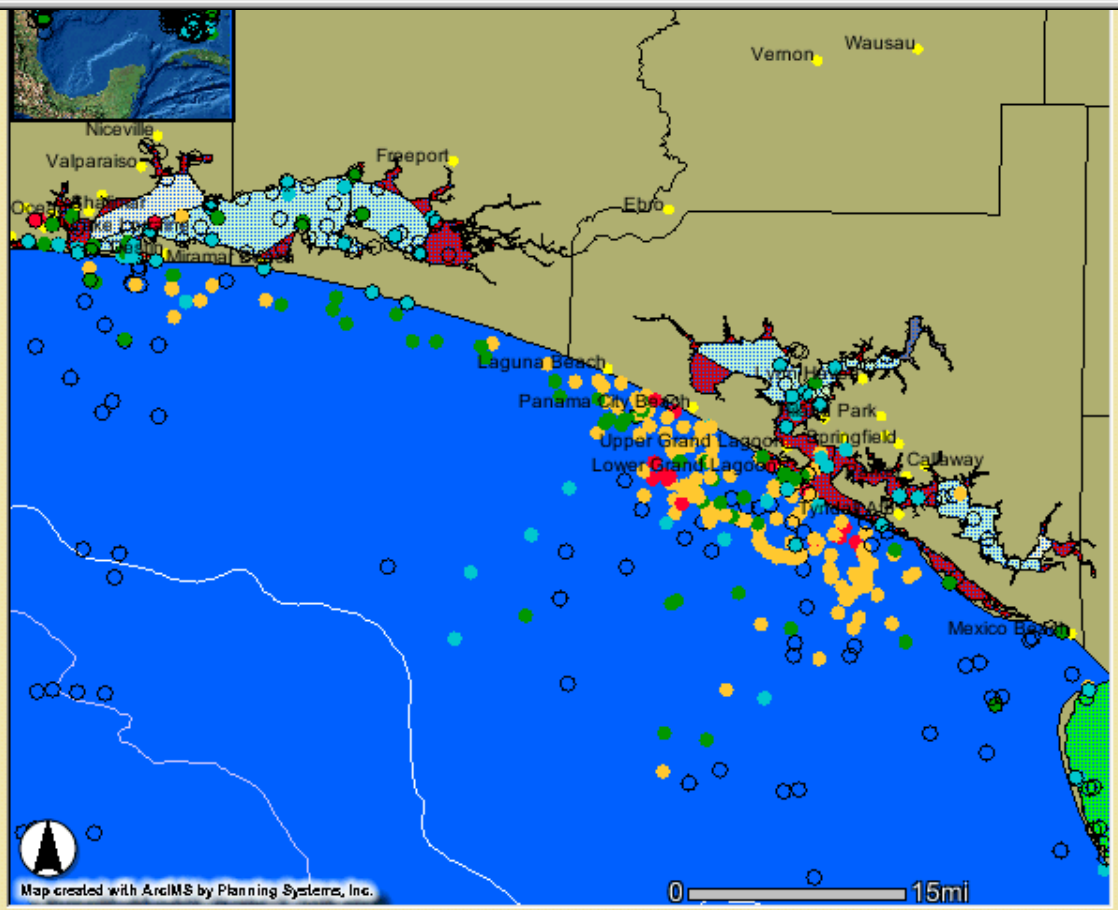
Query/Selection Results - Microsoft Internet Explorer

GOM Cell Counts

Rec	ID	DATE	STATE	LOCATION	STATION	LAT_N	LONG_W	BREVIS_CL	H2O_TEMP_C	SAL_PPT	DO_PPM	CHLOROPHYL	COMMENTS	DATA_SRC
1	16903	Fri, 4 Aug 2000 00:00:00	FL	Panama City, 5 mi. off		30.0742	-85.8408	0	0	0		0.00000		Florida Marine Research Institute - Karen Steidinger
2	17909	Tue, 3 Oct 2000 00:00:00	FL	PD32		30.0983	-85.8407	161000	0	0		0.00000		Florida Marine Research Institute - Karen Steidinger

Visible Active

- [x] GOM Cell Counts
- [x] Shellfish Areas
- [x] Bathymetry
- [ ] Buoys
- [x] Cities
- [ ] Major Rivers
- [x] Counties
- [ ] Satellite image



Texas | Louisiana | Mississippi | Alabama | Florida

Cell Counts
- Not Present
- Very Low
- Low
- Medium
- High

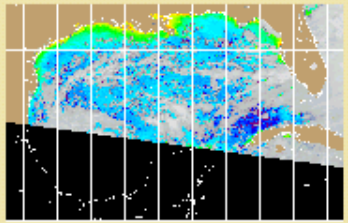
Refresh

Begin Year: 1996 | End Year: 2001

Begin Month: January | End Month: December

Begin Day: 1 | End Day: 31

Submit



Map It

- SST
- Chlorophyll

Active Tool: Identify

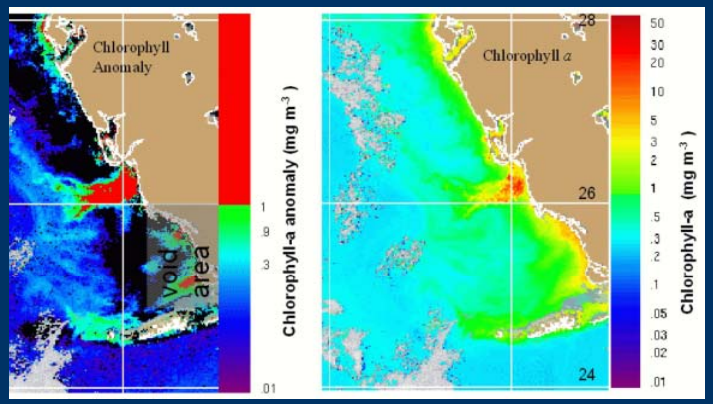
|<< << Current Date >> >>|

Obstacles and Challenges

- How quickly can samples be enumerated and the data released?
  - 1-2 people/State qualified to accurately identify and enumerate cells
  - legal barriers to related to shellfish bed closures (30 d release limit?)
  - continue to rely on word-of-mouth from HAB experts or public reports of fish kills?

- Limited capacity to routinely monitor coastal waters
  - monitoring driven by event response
  - how to identify conditions conducive to blooms?

- Utility of Satellite Ocean Color sensors
  - detection limits of ~50,000-100,000 cells/L
  - need ground truth/validation of nearshore/beach
  - *K. brevis*-flag appears to work in FL, but does it work elsewhere?



Case Study Products

- Visualization of events prior to, during, and following K. brevis blooms
- A web-based portal system for linking and integrating multiple data types from multiple sources
- A simulation of the blooms to demonstrate the benefits of timely data integration and information dissemination
- Report to Steering Committee
  - Addressing question: With the relevant and timely data, could we have provided early alerts and forecasted transport of *K. brevis*?
  - includes obstacles and challenges identified during Case Study
  - Recommendations for developing and implementing a real-time or near real-time HABs observing system

Acknowledgements

Partner Organizations

- USEPA/GMP
- NAML/LABNET
- NOAA – NCDDC, NOS, Coastwatch
- US-CGOOS
- CNMOC
- Alabama (DISL, ADCNR, ADPH, ADEM)
- Florida (FDACS, FFWCC/FRMI)
- Louisiana (LDEQ, LDHH, LUMCON, LSU)
- Mississippi (MDMR, MDEQ, USM)
- Texas (UTMSI, TDH, TPWD)

Other Contributors

- NAVOCEANO
- USFDA
- USACoE
- NRL
- SAML/CASTNET
- U. Colorado
- MMS
- Planning Systems Inc.
- Neptune Sciences Inc.
- Anteon Corp.